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FUEL PIPELINE OF DIESEL ENGINES AND DIESEL COMPRESSORS

**Description and maintenance
instructions
U641-A76-240**

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50X1-HUM

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I. DESCRIPTION

A. PURPOSE AND MAIN SPECIFICATIONS

The fuel pipeline of diesel engines and diesel compressors is designed to meet the following purposes:

1. Delivery of fuel from the ship's fuel tanks to service fuel tank 31 and delivery of fuel from service tank 31 to diesel fuel feed pumps.
2. Delivery of fuel from service fuel tank 31 to fuel injection pumps of diesel compressors.
3. Delivery of fuel right to diesel engine fuel feed pumps in by-pass of the service fuel tanks.
4. Checking fuel consumption by diesel engines.
5. Pumping-through and pressure-testing of diesel unit injectors.
6. Pressure-testing of fuel pipelines of diesel engines and diesel compressors.
7. Evacuation of fuel from the drain tank.

The fuel pipeline of diesel engines is composed of seamless steel pipes, dia.44.5x2.5 with flanged connections; seamless pipes, dia.32x2, 25x2, 22x2, 14x1.5, 10x2 and red copper pipes, dia.6x1.5 with union connections. The pipes are connected to the diesel engine by means of rubberized cloth connections.

Service life of rubberized cloth connections - 3 years.

Material used for fittings is brass, for steel pipeline connections - steel and for red copper pipeline connections - brass.

Sealing gaskets are made of paronite.

The pipeline is designed for delivering diesel fuel, grade DC.

3

SECRET

50X1-HUM

SECRET

50X1-HUM

3. PRINCIPLE OF OPERATION AND DESCRIPTION OF SEPARATE UNITS

The system includes the following:

1. Service tank 31 with fuel gauges 51, 54.

2. Fuel filters 13.

3. Primary fuel filters 13, 38, 39.

4. Secondary fuel filters 14, 20, 37.

5. Switch-over device 53.

6. Fuel filters 26, 30 of diesel compressors.

7. Fuel flowmeters 3, type **ДН15-М**.

8. Straight cocks 4.

9. Control valve 52.

10. Fuel instruments.

11. Fuel filters 58 before fuel flowmeters.

Fuel is delivered from fuel tanks to service tank 31 along ship's line, which is actuated by the compensating water pressure created by the control and starting pump. The fuel passes along the pipes through straight cocks 4, primary fuel filters 58, fuel flowmeters 3, straight cocks 4, control valve 52. Valve 52 is connected to service tank 31 by means of pipe connections of which one is connected to the left-hand half of the tank and the other to the right-hand half.

The fuel level in service tank 31 is registered by fuel gauges 51, 54 connected to each half of the service tank and operating on the principle of communicating vessels.

Fuel gauges 51 and 54 are graduated through 25 litres.

To ensure a remote control of the fuel pipeline the knob of switch-over device 53 and fuel gauges 51, 54 are installed on the bulkhead at frame 83 in the diesel engine control room.

Delivery of fuel oil from the ship's fuel tanks is performed as a rule via fuel flowmeters 3. When necessary, the delivery may be performed without use of fuel flowmeters via the pipe with cock 2. In this case fuel consumption is registered according to the readings of fuel gauges 51 and 54.

SECRET

50X1-HUM

SECRET

50X1-HUM

From service tank 31 fuel passes along the pipes through control valve 52, cocks 5, 46, 47, primary fuel filters 13, 38, 39, rubberized cloth hoses and enters the suction chambers of fuel feed pumps of 2442 diesel engines.

From the suction chambers of fuel feed pumps the fuel is delivered to diesel unit injectors along the pipes through rubberized cloth hoses, cocks 18, 16, 23, 21, 33, 35, secondary fuel filters 14, 20, 37, cocks 15, 19, 36 and rubberized cloth hoses.

Cocks 18, 23, 33 are designed for delivery of fuel to diesel unit injectors without the use of fuel feed pumps in case the latter get out of operation, while cocks 15, 16, 19, 21, 35 and 36 are designed for cutting off secondary fuel filters of diesel engines for the period of replacing filtering elements in the filters.

Excessive fuel from diesel unit injectors is evacuated along the pipes through reducing valves 22, 25 and 32 suction chambers of diesel fuel feed pumps.

For description of filters and reducing valves as well as for the maintenance instructions see "Diesel Engine 2442. Service Manual".

For determining fuel specific consumption by diesel engines, measuring tank 56 is connected to the system by means of three-way cocks 5, 46, 47 and straight cock 57. The measuring tank provides for determination of hourly fuel consumption by each of the operating diesel engines.

Ventilation of service tank 31 is performed by means of pipes with cock 42 running from upper sections of both halves of the service tank.

Fuel and incidental compensating water are drained from service tank 31 along the pipes with straight cocks 49, 50 and from fuel gauges 51, 54 through drain cocks 48 and 55.

Cocks 40 and 41 are checking ones and serve for determining the presence of water in the fuel tank.

Ventilation and drain pipes of service tank 31 run to the funnel with cock 44 mounted on the drain fuel line.

SECRET

50X1-HUM

SECRET

50X1-HUM

Fuel for diesel compressors **ДК-2** is delivered from service fuel tank 31 through three-way cock 12, cocks 27, 29, filters 26, 30 to fuel injection pumps of the diesel compressors.

- Mounted in compartment V on the starboard at frame 83 is manual pump 10. Manual pump 10 is designed for pumping fuel from drain fuel tank over to service fuel tank 31 as well as to any of the ship's fuel tanks.

Service Fuel Tank

(Appendix 2)

The service fuel tank of 1200 lit capacity is designed for delivery of fuel to diesel engines and diesel compressors. To prevent water from getting into the fuel system of diesel engines and diesel compressors together with fuel, the tank is divided into two halves for 600 lit of fuel each.

Each half of the tank is provided with a settler. When fuel is being consumed from one half, the fuel in the other half is settling.

Welded into the bottom of each half of the service tank are four unions:

- union for delivery of fuel to the **ДК-2** diesel compressor;
- two unions for draining deposit from the settler;
- union for connection with the fuel gauge;
- flange for filling the tank and for feeding the diesel engines.

Welded into the front end face of each half of the tank are another union running to the fuel gauge and a flange for ventilating the tank.

For cleaning the tank each half is provided with hatch 100.

Control Valve

(Appendix 3)

The control valve is designed to ensure the delivery of fuel to diesel engines from one half of the service tank and simultaneous filling-up of the other half with fuel. Plug 102 of the control valve by means of switch-over device 53 may be set only in such a position when one of the service tank halves is being filled up while the other half serves to feed the diesel engines.

6

SECRET

50X1-HUM

SECRET

50X1-HUM

Change-Over Device

(Appendix 4)

The change-over device serves to ensure remote operation of control valve 52. To this end handwheel 104 of the change-over device is mounted on the bulkhead at frame 83 in the diesel engines control room.

Measuring Tank

(Appendix 5)

The measuring tank serves to determine an hourly fuel consumption by the operating diesel engines.

The measuring tank consists of three containers 105, 106 and two glass pipes 107 with notches.

The consumption of fuel by diesel engines is determined by the time of consuming the fuel contained between the notches on glass pipes 107 of the measuring tank. Actual capacity of the measuring tank between the notches is marked on the middle section of the tank.

Containers 105 are auxiliary ones and serve to mark the time of beginning and finishing of measurements, as well as to ensure continuous fuel supply when changing over from operation on fuel delivery from the service tank to the operation on fuel delivered from the measuring tank and vice versa.

Primary Fuel Filter of Diesel Compressors and Fuel Flowmeters

Filters 26, 30 and 58 are made of screens with 0.7x0.7 mm meshes. A filter consists of a steel body with cover and a brass filtering cup with screen. For ventilation of the filter its cover is provided with a plug. The deposit is drained through the plug provided in the body bottom.

7

SECRET

50X1-HUM

C. MEASURING INSTRUMENTS

Ref.No. in key diagram	Designation and type of instrument	Type of indicating instrument and graduation of scale	Normal reading	Place of installation of indi- cating instrument and name of panel	Note
			Maximum reading, red line		
3 51,54	Measurement of pressure before the secondary filter	MTK100Bx10 0-10 kgf/cm ²	4/6.5 kgf/cm ²	Pressure gauge panel in diesel control room	
	Measurement of pressure after second- ary fuel filter	MTK100Bx10 0-10 kgf/cm ²	2.5/4 kgf/cm ²	Pressure gauge panel in diesel control room	
	Fuel oil meter	ДН-15М	-	In diesel control room	
	Fuel gauge in the service tank	0-600 through 25 litres	<u>max. 550</u> <u>min. 50</u>	On bulkhead at frame 83 in diesel control room	

SECRET

SECRET
50X1-HUM
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SECRET

50X1-HUM

II. MAINTENANCE INSTRUCTIONS

A. General Care and Maintenance

1. See that union and shock absorbing connections are tight. In case of leakage tighten up the connections or replace the gaskets or rubberized cloth connections.

2. See that cut-off and switch-over fittings are in good repair.

3. Clean the filters in conformity with the "Diesel Engine 2442. Service Manual".

Note. In emergency cases it is permissible to replace the secondary fuel filter filtering elements of diesel engines without stopping the engines. For this purpose cut off the secondary fuel filter by setting cock 16, 21 or 35 in the position for operation without secondary fuel filter and by closing cock 15, 19 or 36. Operation of diesel engine without secondary fuel filter is permissible for not more than 10 min.

4. For care of the fuel flowmeter see the "DH-15M Fuel Oil Meter Description, Maintenance and Mounting Instructions".

Initial Position

5. The fuel tank is filled up with fuel. The plug of control valve 52 in accordance with the indicating plate is set in the position: "for filling up the tank", "to diesel engine".

The plug of cock 12 is set in the position cutting off the passage of fuel from service tank 31 to DR-2 diesel compressors.

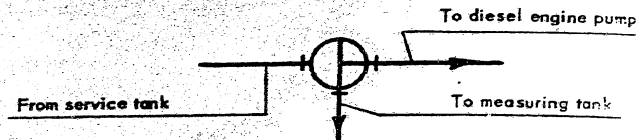
6. Plugs of cocks 5, 46, 47 are set in position cutting off fuel passage from service tank 31 to diesel engines and to measuring tank 56.

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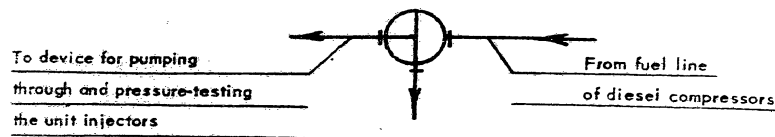
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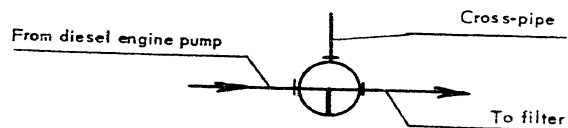
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7. Plug of cock 28 is set in position cutting off the fuel line of diesel compressors from the device for pumping through and pressure testing the unit injectors.



8. Plugs of cocks 18, 23, 33 are set in position cutting off the cross-pipe between intake and delivery lines of diesel fuel feed pumps while plugs of cocks 16, 21 and 35 are set in position cutting off the cross-pipe in by-pass of diesel engine secondary fuel filters.



9. Cocks 15, 17, 19, 24, 34, 36, 42 and 44 are open.

10. All the rest cocks are closed.

CAUTION. Cock 42 must always be open. Close it in case of big list only, with diesel engines not operating, and fuel pouring out of tanks.

Cock 44 must always be open. Close it only in case of accident when water enters the diesel engine compartment through this cock.

SECRET

50X1-HUM

SECRET

50X1-HUM

Note. Cocks 17, 24, 34 are to be closed only during repair of pressure relay.
Cocks 15, 19, 36 are to be closed only during replacement of filtering elements of diesel engine secondary fuel filters.
The cock handles should be removed and kept separately to avoid an incidental closing of the cocks.

B. PREPARATION OF PIPELINE FOR STARTING

Filling up of Service Fuel Tank

To fill up service fuel tank 31, do the following:

1. Deliver compensating water into ship's fuel tanks in accordance with the "Description and Instructions for Maintenance of Ship's Fuel System".
2. Open cocks 1 and 4.
3. Making use of change-over device 53, set the plug of control valve 52 in turn for filling up of one half of tank 31 then of the other half watching the fuel level by fuel gauges 51 and 54.

CAUTION. Never fill each half of tank 31 with more than 550 litres of fuel to avoid fuel loss through the tank ventilation pipeline.

4. After filling up tank 31 close cocks 1 and 4.
5. Register the readings of fuel flowmeters 3.

(a) Preparation of diesel engines for starting

6. Check service tank 31 for absence of water by inspecting fuel gauges 51, 54 and by opening check cocks 40 and 41. In case water is present in the tank, drain it into the drain line by opening cocks 49, 50, 48 and 55.
7. After draining water close cocks 40, 41, 49, 50, 48 and 55.
8. See that the plug of control valve 52 and plugs of cocks 18, 16, 23, 21, 33, 35 are set in the initial position. Set the plugs of cocks 5, 46 and 47 in the position: "From service tank to diesel engine pump".

Note. In case of damage of change-over device 53 or service tank 31 the fuel can be delivered to the diesel engines without the use of them. For this purpose open cock 6 and cocks 8, 43 and 45.

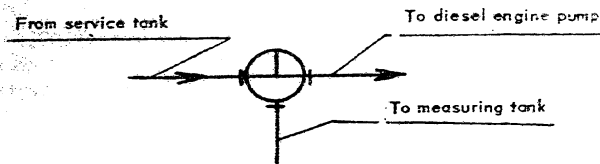
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50X1-HUM

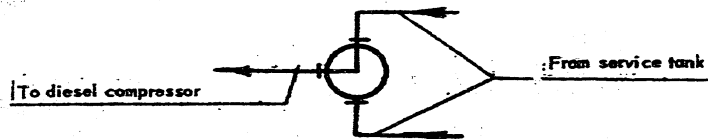
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50X1-HUM

**(b) Preparation of diesel compressors for starting**

9. Fulfill operations according to Items 1 through 7.

10. Set the plug of three-way cock 12 in the position corresponding to consumption by diesel compressor from that half of service tank 31 which is connected by control valve 52 to diesel engine.



11. Open cocks 27 and 29.

When starting main diesel engines:

12. Follow the directions of "Diesel Engine 2Д42. Service Manual".

When starting diesel compressors:

13. See that the plugs of cocks 27 and 29 are open.

14. Start the diesel compressors as described in "ДК-2 Diesel Compressors Description and Maintenance Instructions".

C. MAINTENANCE DURING OPERATION

1. During operation of diesel engines watch the consumption of fuel from service tank 31 by keeping an eye on fuel gauges 51 and 54.

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SECRET

50X1-HUM

SECRET

50X1-HUM

When fuel capacity in one half reaches 50 litres set control valve 52 by turning the change-over device for consumption of fuel from the other half. The empty half of the tank is to be filled up from the ship's fuel pipeline.

CAUTION. In case water gets into the idle half of the service tank (due to abnormal fuel delivery from the ship's fuel system) stop filling it with fuel, drain water from the tank and pipeline having opened cocks 49, 48, 50 and 55 and having unscrewed drain plugs on fuel filters. Resume filling from another fuel tank in conformity with the "Ship's Fuel Pipeline Description and Maintenance Instructions".

2. During operation of the ДК-2 diesel compressors watch the fuel level in tank 31 by the fuel gauges and fill up the tank if need be. When filling the empty half switch over cock 12 for consumption of fuel from the filled up half of the service tank.

Note. During simultaneous operation of diesel compressors and diesel engines switch over cock 12 only upon receiving a signal of the engine operator from the diesel engine control room.

3. Watch the readings of the pressure gauges. Their readings should correspond to the 2Д42 diesel engine maintenance instructions (see "Diesel Engine 2Д42. Service Manual").

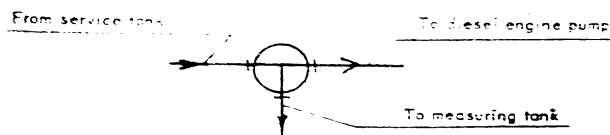
4. Watch the readings of fuel oil meters 3 and enter the readings of the meters into the log after every filling of service tank 31 with fuel.

5. After stopping the diesel engines or diesel compressors set the pipeline into the initial position.

Measurement of Fuel Consumption by Diesel Engines

Measurement of fuel consumption by starboard engine

6. Set the plug of cock 3 in the position connecting the measuring tank filling line and open cock 3.



13

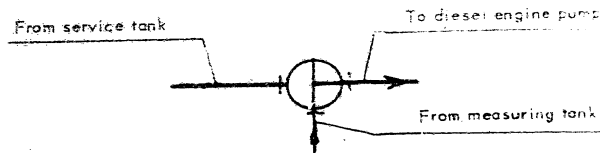
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50X1-HUM

SECRET

50X1-HUM

7. Fill up measuring tank 56. Prepare a stop watch.
8. After the measuring tank has been filled up set the plug of cock 5 in the position "From measuring tank - to diesel engine pump".



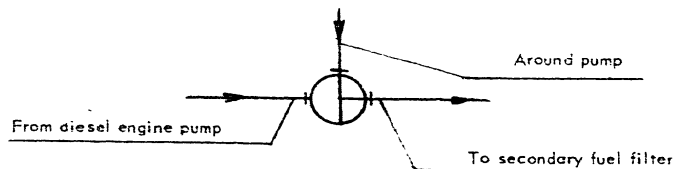
9. Watch the fuel level by the measuring tank pipe and as soon as it reaches the notch on the upper pipe, start the watch. When fuel level reaches the notch on the lower pipe of the measuring tank stop the watch and set the plug of cock 5 in the position "From service tank - to diesel engines".

Close cock 57.

Note. When measuring the consumption of fuel by the port side and centre engines follow the same procedure with the following exception: during measuring fuel consumption by port side engine cock 47 takes the place of cock 5 and during measuring fuel consumption by the centre engine cock 46 should be used instead of cock 5.

Pressure-Testing of Fuel System by Manual Pump

10. Prior to pressure-testing the fuel system see that cocks 9, 11, 2, 4 and 6 are closed.
- Open cocks 8, 43, 45 and 7.
11. Set three-way cocks 18, 23 and 33 in the position cutting off the fuel feed pumps of diesel engines from the fuel system.



14

SECRET

50X1-HUM

SECRET

50X1-HUM

12. Operate manual pump 10 watching the pipeline pressure by the pressure gauge after secondary fuel filter. The pressure must not exceed 2 kg/cm².

13. After the pressure-testing is over bring the system into the initial position.

Evacuating Fuel from Drain Tank by Means of Manual Pump

Evacuation into a portable container

14. Open the non-return control valve in the drain pipeline in accordance with the "Ship's Drain System, Description and Maintenance Instructions".

15. Open cocks 11 and 9. Operate the manual pump.

Evacuation into the fuel tank

16. Open the non-return control valve in the drain pipeline.

17. Open cocks 11, 6, 2. Operate the manual pump.

Note. Evacuation into the fuel tank is allowed only in exceptional cases when it is not possible to evacuate fuel into the ship's storage tanks or into a portable container.

Prior to evacuation of fuel open cock 9 to see that there is no water in the pipeline.

Evacuation into ship's storage tank

18. Open the non-return control valve in the drain pipeline in accordance with the "Ship's Drain System, Description and Maintenance Instructions".

19. See that cocks 2, 4 and 7 are closed.

20. Open cocks 11, 6. Operate the manual pump.

21. Handle the ship's drain pipeline in conformity with the "Ship's Fuel Pipeline, Description and Maintenance Instructions".

After fuel has been evacuated bring the system into the initial position.

D. MAINTENANCE DURING PROLONGED IDLENESS

1. Drain the pipeline by opening cocks 49, 48, 50 and 55 and unscrew the drain plugs on the fuel filters.

SECRET

50X1-HUM

SECRET

50X1-HUM

and screen fuel filters. Replace filter-

ing the filter

the filter

the filter

When assembling and assembly of pipelines see that no foreign ob-
jects get into the pipelines. To avoid this, blank off the disconnected ends
with blanking or with metal plugs. It is prohibited to plug the pipes with tow
rope or other material liable for getting into the pipeline.

To avoid damage of parts during disassembly and assembly of pipe-
lines use only those tools which are specified in the repair manuals.

After each repair of the system check the pipelines or separate sec-
tions thereof subjected to repair for tightness.

FAULTS, DAMAGES AND REMEDIES

Faults	Possible causes	Remedies on board the ship
1 Fuel leakage through connections	Untightness of gasket	Tighten up connections replace gaskets (with pressure relieved)
2 Fuel leakage through cocks and valves	Untightness of valve discs, seats, cock plugs and oil seals	Lap the valve discs, seats and cock plugs. Tighten oil seals or replace packing
3 Fuel leakage from service tank or fuel gauges	Untightness of connections, damage of glasses	Change over to operation without the use of tanks (see Note to Item 8). Eliminate leakage. Replace gaskets or glasses

SECRET

50X1-HUM

SECRET

50X1-HUM

...on board the
Ship

Wash fuel filter 13, 38
or 40

Wash fuel filter 26
or 30

Before fuel flowmeter
is replaced register
fuel consumption by
fuel gauges 51, 54.
Wash filters 58

REGULAR MAINTENANCE INSPECTIONS AND REPAIRS

Daily Inspection

1. Examine the pipelines, fittings and measuring instruments. Check to ensure that seals are present on the pressure gauges.
2. In case of leakage tighten the flange and union connections.

Weekly Inspection

1. Carry out everything pertaining to the daily inspection and, besides, do the following:
2. Check the plugs. See that the pipelines are connected correctly.
3. Check the manual fuel pump and check it in operation.

17

SECRET

50X1-HUM

SECRET

50X1-HUM

... inspection and besides, the

... and both connections,

... compressors and fuel

... ..

... ..

... according to the monthly inspection and, besides

... condition, carry out repairs and

... fuel pump after a replacement of piston rings, valves,

... fuel pipeline for tightness as follows (see diagram

... pressure of 0.5 kgf/cm^2

... manual pump 10 from drain pipeline to cock 11.

... pressure of 2.0 kgf/cm^2

... ship's fuel pipeline to control valve 52.

... three-way cocks 5, 46, 47 to fuel feed pumps of diesel engines.

... pipes of manual pump 10 and intake pipes after cocks 7 and 11.

... after three-way cock 12 to fuel injection pumps of **ДК-2** diesel

... hydraulic pressure of 6 kgf/cm^2

... delivery pipes from diesel engine feed pumps to secondary fuel filters 14,

... and from filters to pipelines of unit injectors.

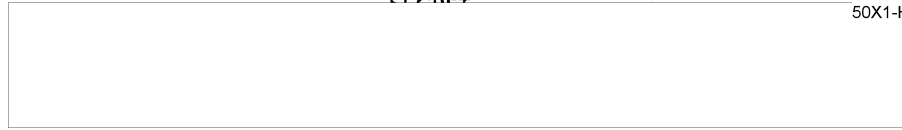
... pressure gauge pipes.

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SECRET

50X1-HUM



1. Diesel engine 2Д42. Service Manual.
 2. Diesel Compressor ДК-2. Description and Maintenance Instructions.
 3. Ship's Fuel Pipeline. Description and Maintenance Instructions.
 4. Ship's Drain System. Description and Maintenance Instructions.
 5. Fuel Flowmeter ДН-15М. Description, Maintenance and Mounting Instructions.

1. Fuel tank capacity.

2. Fuel tank capacity of 1200 litres is divided by a high rate of fuel consumption of 600 litres each.

3. Manual pump with an output of 12 litres per minute at 48 double strokes. Pressure head equals 10 m of water column. Suction head - 5 m of water column.

4. Formula for calculating an hour consumption of fuel by diesel engine as a result of measuring the fuel consumption by the measuring tank is as follows:

$$G = \frac{3600 \cdot V}{t} \cdot \gamma$$

where:

G - fuel consumption, kg/hr;

V - volume of measuring tank between notches, lit;

t - time of consumption of fuel volume contained between the measuring tank notches, sec;

γ - specific weight of fuel, kg/cu.dm.

When operating the fuel system, observe the following instructions as well:

1. Diesel engine 2Д42. Service Manual;
2. Diesel Compressor ДК-2. Description and Maintenance Instructions.
3. Ship's Fuel Pipeline. Description and Maintenance Instructions.
4. Ship's Drain System. Description and Maintenance Instructions.
5. Fuel Flowmeter ДН-15М. Description, Maintenance and Mounting Instructions.

19

SECRET

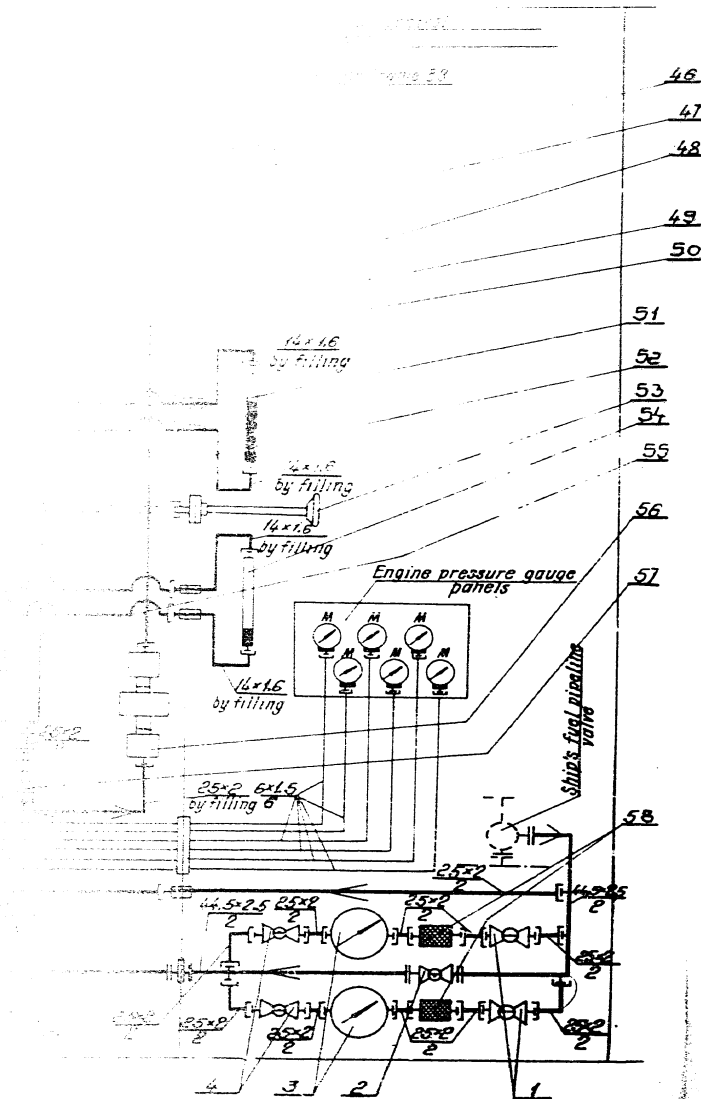


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50X1-HUM

Appendix No. 1



KEY DIAGRAM OF FUEL SYSTEM

20	Service tank drain pipeline	---
19	Service tank ventilation pipeline	---
18	Fuel gauge	
17	Fuel feed pump	
16	Control valve	
15	Funnel	
14	Direction of fuel motion	
13	Rubberized cloth connection	
12	Flange connection	
11	Threaded connection with union nut	
10	Adapter	
9	Measuring tank	
8	Fuel flowmeter	
7	Secondary fuel filter	
6	Primary fuel filter	
5	Pressure gauge	
4	Straight cock	
3	Three-way cock with L-shaped plug	
2	Three-way cock with T-shaped plug	
1	Reducing valve	
No.	Description	Symbol

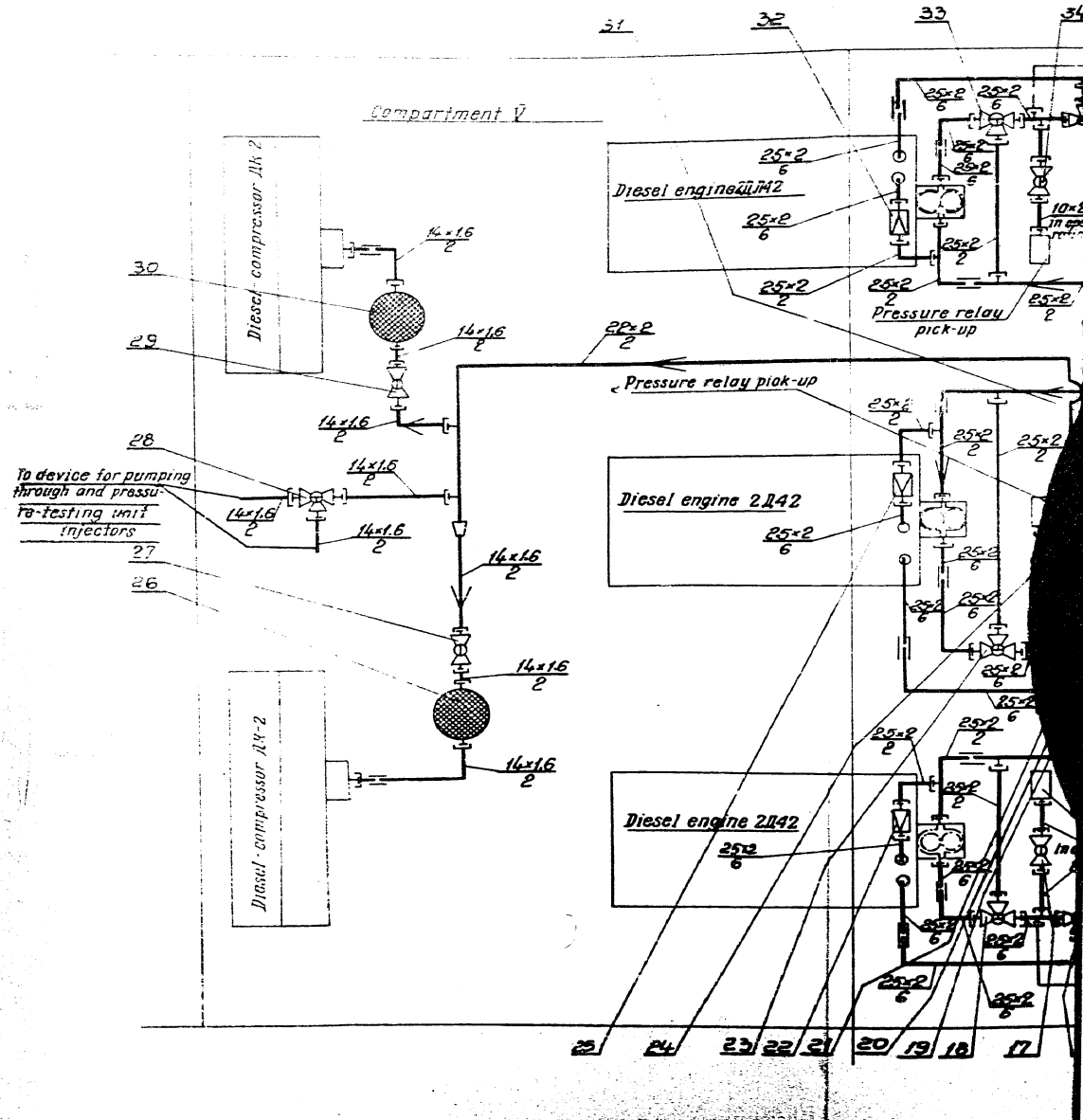
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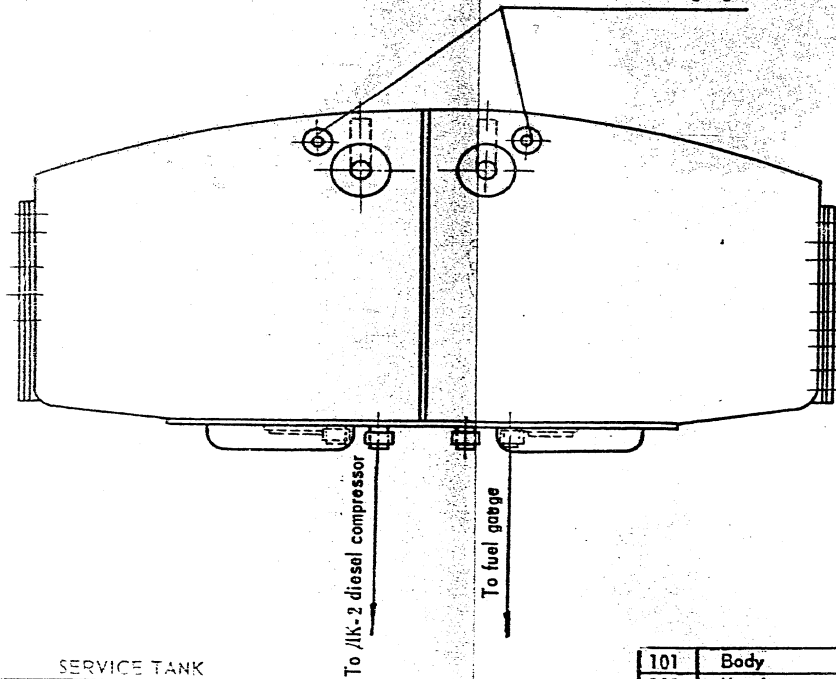
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50X1-HUM

Appendix No. 2

View along arrow A

To fuel gauge



SERVICE TANK

To /K-2 diesel compressor

To fuel gauge

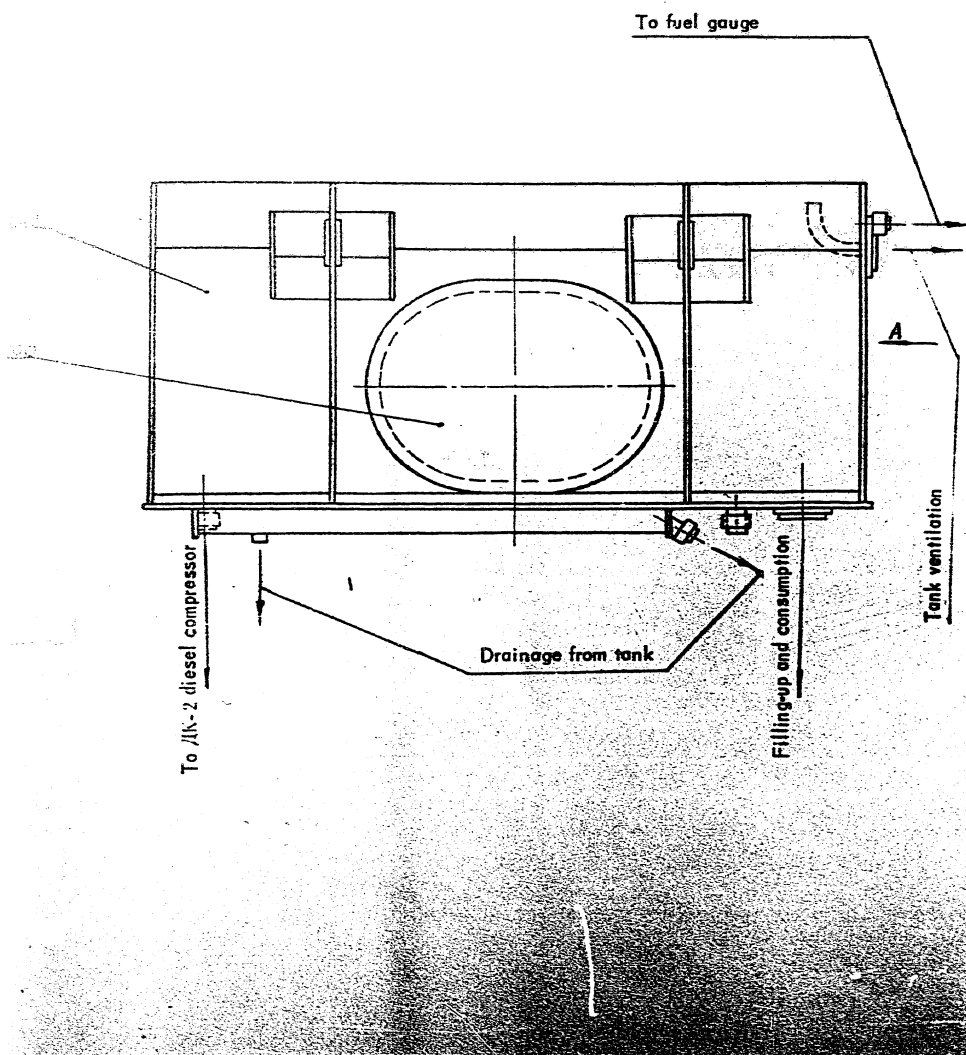
101	Body
100	Hatch
Nos	Description

SECRET

50X1-HUM

SECRET

50X1-HUM



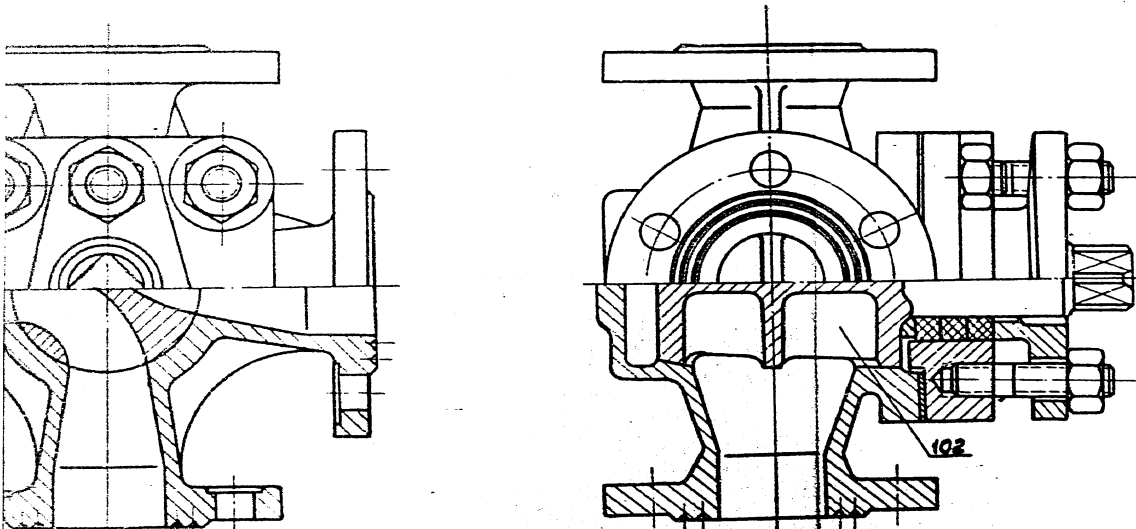
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SECRET

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Appendix No. 3



CONTROL VALVE

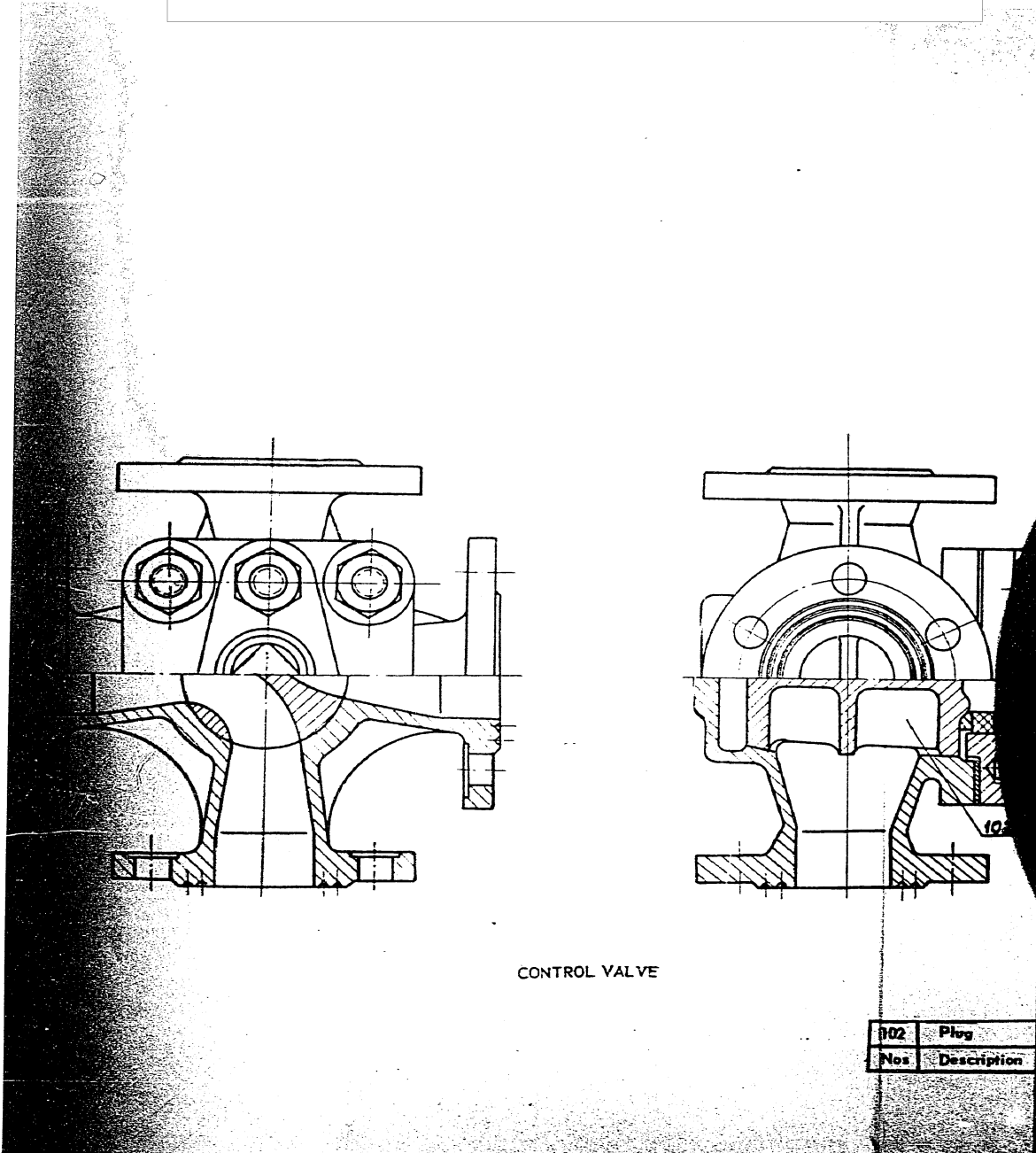
102	Plug
No.	Description

SECRET

50X1-HUM

SECRET

50X1-HUM



CONTROL VALVE

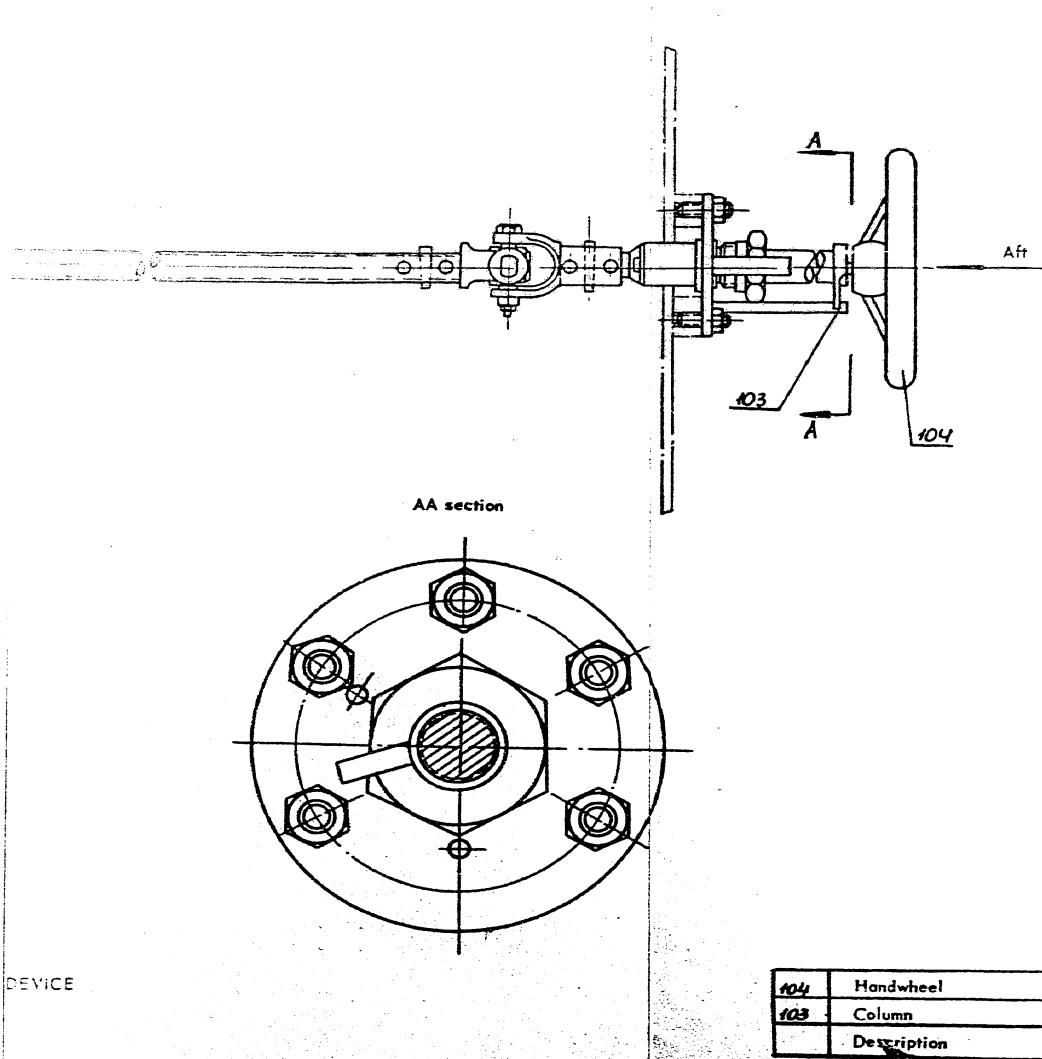
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50X1-HUM

Appendix No. 4



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50X1-HUM

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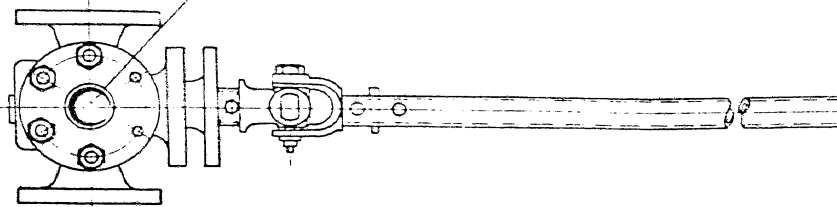
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Service fuel tank

Filling of tank

To service tank

To diesel engine



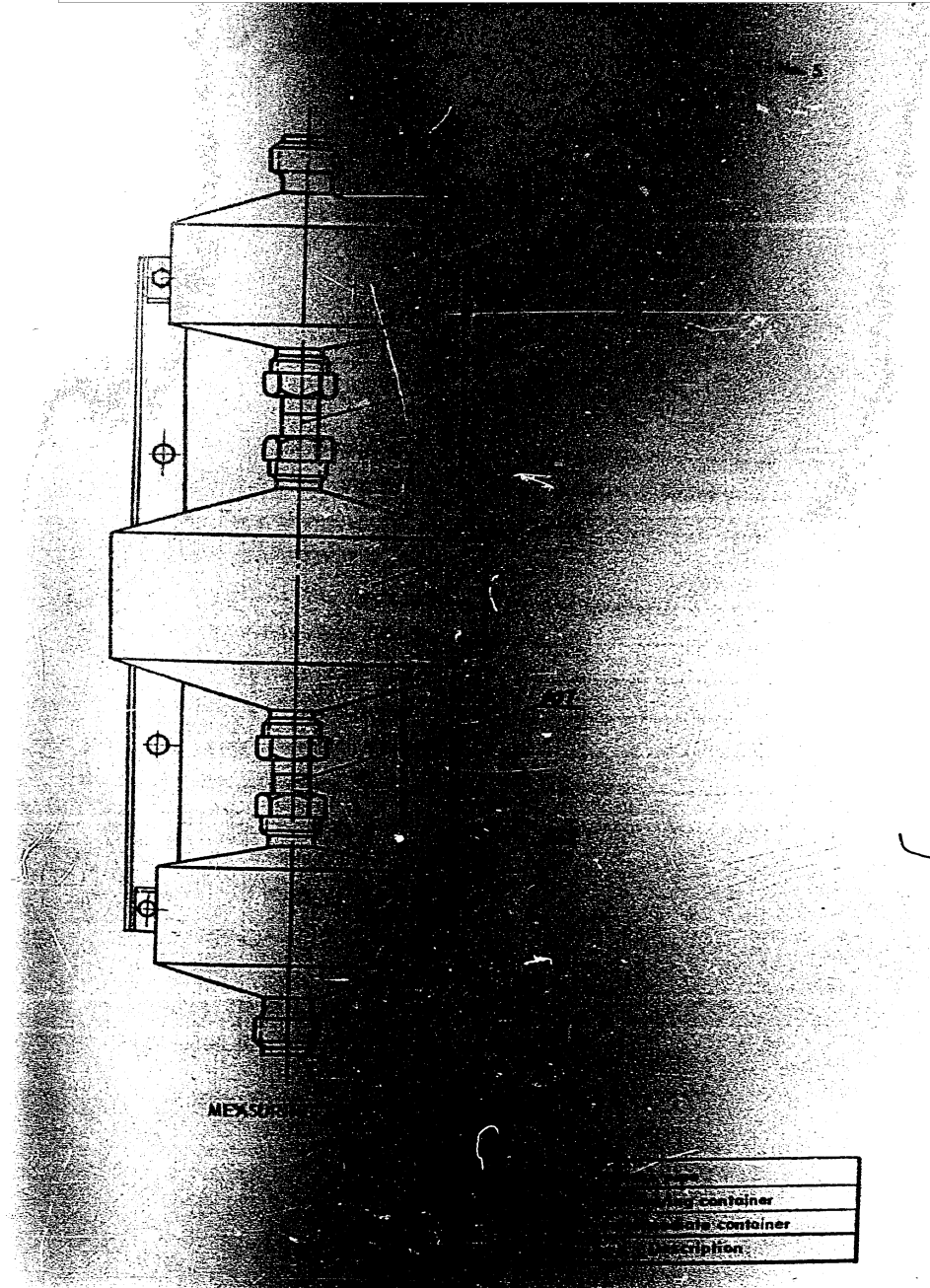
CHANGE-OVER DEVICE

SECRET

50X1-HUM

SECRET

50X1-HUM



SECRET

50X1-HUM

SECRET

50X1-HUM

CONTENTS

	Page
DESCRIPTION	
A. Purpose and Main Specifications	3
B. General Description and Description of Separate Units	4
C. Measuring Instruments	8
II. MAINTENANCE INSTRUCTIONS	
A. General Care and Maintenance	9
B. Preparation of Pipeline for Starting	11
C. Maintenance during Operation	12
D. Maintenance during Prolonged Idleness	15
E. Faults, Damages and Remedies	16
F. Scheduled Maintenance, Inspections and Repairs	17
G. Reference Data	19
APPENDICES	
A. Key Diagram of Fuel System	
B. Service Tank	
C. Control Valve	
D. Change-Over Device	
E. Measuring Tank	

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